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(54) Name pronunciation by synthesizer.

(57) An apparatus and method for correctly pronouncing proper names from text using a computer provides a dictionary which performs an initial search for the name. If the name is not in the dictionary, it is sent to a filter which either positively identifies a single language group or eliminates one or more language groups as the language group of origin for that word. When the filter cannot positively identify the language group of origin for the name, a list of possible language groups is sent to a grapheme analyzer. Using grapheme analysis, the most probable language group of origin for the name is determined and sent to a language-sensitive letter-to-sound section. In this section, the name is compared with language-sensitive rules to provide accurate phonemics and stress information for the name. The phonemics (including stress information) are sent to a voice realization unit for audio output of the name.

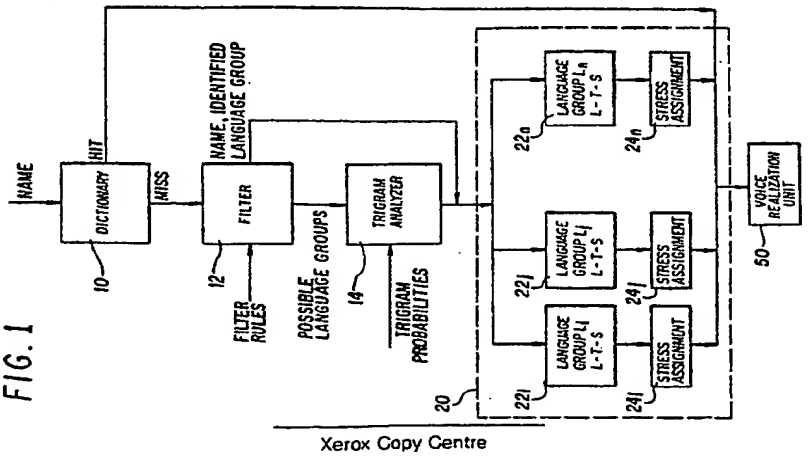

FIG. 1

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NAME PRONUNCIATION BY SYNTHESIZER

The present invention relates to text-to-speech conversion by a computer, and specifically to correctly pronouncing proper names from text.

Name pronunciation may be used in the area of field service within the telephone and computer industries. It is also found within larger corporations having reverse directory assistance (number to name) as well as in text-messaging systems where the last name field is a common entity.

There are many device commercially available which synthesize American English speech by computer. One of the functions sought for speech synthesis which presents special problems is the pronunciation of an unlimited number of ethnically diverse surnames. Due to the extremely large number of different surnames in an ethnically diverse country such as the United States, the pronouncing of a surname cannot be practically implemented at present by use of other voice output technologies such as audiotape or digitized stored voice.

There is typically an inverse relation between the pronunciation accuracy of a speech synthesizer in its source language and the pronunciation accuracy of the same synthesizer in a second language. The United States is an ethnically heterogeneous and diverse country with names deriving from languages which range from the common Indo-European ones such as French, Italian, Polish, Spanish, German, Irish, etc. to more exotic ones such as Japanese, Armenian, Chinese, Arabic, and Vietnamese. The pronunciation of surnames from the various ethnic groups does not conform to the rules of standard American English. For example, most Germanic names are stressed on the first syllable, whereas Japanese and Spanish names tend to have penultimate stress, and French names, final stress. Similarly, the orthographic sequence CH is pronounced [c] in English names (e.g. CHILDERS), [s] in French names such as CHARPENTIER, and [k] in Italian names such as BRONCHETTI. Human speakers often provide correct pronunciation by "knowing" the language of origin of the name. The problem faced by a voice synthesizer is speaking these names using the correct pronunciation, but since computers do not "know" the ethnic origin of the name, that pronunciation is often incorrect.

A system has been proposed in the prior art in which a name is first matched against a number of entries in a dictionary which contains the most common names from a number of different language groups. Each dictionary entry contains an orthographic form and a phonetic equivalent. If a match occurs, the phonetic equivalent is sent to a synthesizer which turns it into an audible pronunciation for that name.

When the name is not found in the dictionary, the proposed system used a statistical trigram model. This trigram analysis involved estimating a probability that each three letter sequence (or trigram) in a name is associated with an etymology. When the program saw a new word, a statistical formula was applied in order to estimate for each etymology a probability based on each of the three letter sequences (trigrams) in the word.

The problem with this approach is the accuracy of the trigram analysis. This is because the trigram analysis computes only a probability, and with all language groups being considered as a possible candidate for the language group of origin of a word, the accuracy of the selection of the language group of origin of the word is not as high as when there are fewer possible candidates.

According to one aspect of the present invention there is provided a method for positively identifying or eliminating a language group as a language group of origin for a given word, comprising:

comparing substrings of graphemes of an input word to a stored set of filter rules until either a match of one of the substrings to one of the filter rules positively identifies a language group, or any language group is eliminated when a match of one of the substrings to one of the filter rules indicates a language group is eliminated from consideration as a language group of origin for the input word; and

producing a list of possible non-eliminated language groups of origin when no language group is positively identified as the language group of origin or indicating the language group of origin when the language group of origin is positively identified.

According to another aspect of the present invention there is provided a method for generating correct phonemics for a given input word according to a language group of origins of the input word, the method comprising:

filtering the input word in a filter to identify a language group of origin for the input word or to eliminate at least one language group of origin for the input word;

sending the input word and a language tag indicating a language group of origin for the input word from the filter to a letter-to-sound module containing letter-to-sound rules when the filter positively identifies a language group of origin for the input word;

sending from the filter the input word and any non-eliminated language groups to a grapheme analyser

when a language group of origin for the input word is not positively identified by the filter;
producing a most probable language group of origin for the input word by analysing graphemes in the input word;
sending the input word and the most probable language group of origin to a subset of the letter-to-sound module corresponding to the most probable language group;
producing in the subset of letter-to-sound module segmental phonemics for the input word;
sending the segmental phonemics and the language tag from the letter-to-sound module to a stress assignment section;
producing stress assignment information for the input word in the stress assignment section; and
sending the segmental phonemics and the stress assignment information to a voice realisation unit.

According to this aspect there is also provided apparatus for positively identifying or eliminating a language group as a language group or origin for a given word, comprising:
a filter rule store which stores a set of filter rules, a first subset of the filter rules positively identifying a language group, and a second subset of the filter rules eliminating a language group;
a comparator which compares substrings of graphemes of an input word to the first and second subsets of filter rules until a match of one of the substrings to one of the first subset of filter rules positively identifies a language group or eliminates any language group when a match of one of the substrings to one of the second subset of filter rules indicates a language group is eliminated from consideration as a language group of origin for the input word; and
an output which produces a list of possible language groups of origin when no language group is positively identified as the language group of origin, and which produces an indication of the language group of origin when the language group of origin is positively identified.

The present invention solves the above problem by improving the accuracy of the trigram analysis. This is done by providing a filter which either positively identifies a language group as a language group of origin, or eliminates a language group as a language group of origin for a given input word. The filtering method according to the present invention comprises identifying or eliminating a language group as a language group of origin for an input word according to a stored set of filter rules. The step of identifying or eliminating a language group includes performing an exhaustive search of the rule set using a right-to-left scan. Language groups are eliminated when a match of one of these substrings to one of the filter rules indicates that a language group should be eliminated from consideration as the language group of origin for the input word. This is done until a match of one of the substrings to one of the rules positively identifies a language group. When no language group is positively identified as a language group of origin after all of the substrings for a given input word are compared, a list of possible language groups of origin is produced. This filter method also produces a positively identified language group of original when there is a positive identification.

The advantages of using a filter before the trigram analysis includes avoiding unnecessary trigram analysis when filter rules can positively identify a language group as a language group of origin. When no language group can be positively identified, the filtering method also reduces the chances of an incorrect guess being made in the trigram analysis by reducing the number of possible language groups in consideration as the language group of origin. Through the elimination of some language groups, the identification of a language group of origin is more accurate, as discussed above.

The invention also includes a method for generating correct phonemics for a given input word according to the language group of origin of the input word. This method comprises searching a dictionary for an entry corresponding to an input word, each entry containing a word and phonemics for that word. This entry is then sent to a voice realization unit for pronunciation when the dictionary search reveals an entry corresponding to the input word. The input word is sent to a filter when the input word does not have a corresponding entry in the dictionary.

The next step in the method involves filtering to identify a language group of origin for the input word or to eliminate at least one language group of origin for the input word. When the filter positively identifies a language group of origin for the input word, the input word and a language tag indicating a language group of origin for the input word is sent from the filter to a letter-to-sound module. When a language group of origin is not positively identified by the filter, the input word and any language groups not eliminated are sent from the filter to a trigram analyzer.

A most probably language group of origin for the input word is produced by analyzing trigrams occurring in the input word. This most probably language group of origin produced by the trigram analysis is sent along with the input word to a subset of letter-to-sound rules that correspond to the most probable language group. Phonemics are generated for the input word according to the corresponding subset of letter-to-sound rules.

The invention is all respects also extends to a method and apparatus for speech synthesis incorporating the above features. The speech synthesis may include voice realization arranged to pronounce the word according to the determined language.

The present invention can be put into practice in various ways one of which will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 illustrates a logic block diagram of language identification and phonemics realization modules; and

FIGURE 2 shows a logic block diagram of a name analysis system containing the language group identification and phonemic realization module of Figure 1, constructed in accordance with the present invention.

Figure 1 is a diagram illustrating the various logic blocks of the present invention. The physical embodiment of the system can be realized by a commercially available processor logically arranged as shown.

A name to be pronounced is accepted as an input. The search is made through entries in a dictionary 10 for this input name. Each dictionary entry has a name and phonemics for that name. A semantic tag identifies the word as being a name.

A search for an input name that corresponds to an entry in the dictionary 10 results in a hit. The dictionary 10 will then immediately send the entry (name and phonemics) to a voice realisation unit 50, which pronounces the name according to the phonemics contained in the entry. The pronunciation process for that input word would then be complete.

A dictionary miss occurs when there is no entry corresponding to the input name in the dictionary 10. In order to provide the correct pronunciation, the system attempts to identify the language group of origin of the input name. This is done by sending to a filter 12 the input name which missed in the dictionary 10. The input name is analyzed by the filter 12 in order to either positively identify a language group or eliminate certain language groups from further consideration.

The filter 12 operates to filter out language groups for input names based on a predetermined set of rules. These rules are provided to the filter 12 by a rule store described later.

Each input name is considered to be composed of a string of graphemes. Some strings within an input name will uniquely identify (or eliminate) a language group for that name. For example, according to one rule the string BAUM positively identifies the input name as German, (e.g. TANNENBAUM). According to another rule the string MOTO at the end of a name positively identifies the language group as Japanese (e.g. KAWAMOTO). When there is such a positive identification, the input name and the identified language group (L TAG) are sent directly to a letter-to-sound section 20 that provides the proper phonemics to the voice realization unit 50.

The filter 12 otherwise attempts to eliminate as many language groups as possible from further consideration when positive identification is not possible. This increases probability accuracy of the remaining analysis of the input name. For example, a filter rule provides that if the string -B is at the end of a name, language groups such as Japanese, Slavic, French, Spanish and Irish can be eliminated from further consideration. By this elimination, the following analysis to determine the language group of origin for an input name not positively identified is simplified and improved.

Assuming that no language group can be positively identified as the language group of origin by the filter 12, further analysis is needed. This is performed by a trigram analyzer 14 which receives the input name and the list of any language groups not eliminated by the filter 12. The trigram analyzer 14 parses the string of graphemes (the input name) into trigrams, which are grapheme strings that are three graphemes long. For example, the grapheme string #SMITH# is parsed into the following five trigrams: #SM, SMI, MIT, ITH, TH#. For trigram analysis, the hash sign (word-boundary) is considered a grapheme. Therefore, the number of trigrams is always the same as the number of graphemes in the name.

The probability for each of the trigrams being from a particular language group is input to the trigram analyzer 14. This probability, computed from an analysis of a name data base, is received as an input from a frequency table of trigrams for each language group that was not eliminated by the filter 12. The same thing is also done for each of the other trigrams of the grapheme string.

The following (partial) matrix shows sample probabilities for the surname VITALE:

	Li	Lj	...	Ln
#VI	.0679	.4659		.2093
VIT	.0263	.4145		.0000
ITA	.0490	.7851		.0564
TAL	.1013	.4422		.2384
ALE	.0867	.2602		.2892
LE#	.1884	.3181		.0688
Total Prob.	.0866	.4477		.1437

In the array above, L is a language group and n is the number of language groups not eliminated by the filter 12. The trigram #VI has a probability of .0679 of being from language group Li, .4659 of being from the language group Lj and .2093 of being from language group Ln. Lj is averaged as the highest probability and thus the language group is identified.

The probability of each of the trigrams of the grapheme string (input name) is similarly input to the trigram analyzer 14. The probability of each trigram in an input name is averaged for each language group. This represents the probability of the input name originating from a particular language group. The probability that the grapheme string #VITALE# belongs to a particular language group is produced as a vector of probabilities from the total probability line. From this vector of probabilities, other items such as standard deviation and thresholding can also be calculated. This ensures that a single trigram cannot overly contribute to or distort the total probability.

Although the illustrated embodiment analyzes trigrams, the analyzer 14 can be configured to analyze different length grapheme strings, such as two-grapheme or four-grapheme strings.

In the example above, the trigram analyzer 14 shows that language group Lj is the most probable language group of origin for the given input name, since it has the highest probability. It is this most probable language group that becomes the L TAG for the input name. The L TAG and the input name are then sent to the letter-to-sound section 20 to produce the phonemics for the input.

The filter rules are constructed in such a way that ambiguity of identification is not possible. That is, a language may not be both eliminated and positively identified since a dominance relationship applies such that a positive identification is dominant over an elimination rule in the unlikely event of a conflict.

Similarly, a language group may not be positively identified for more than one language because the filter rules constitute an ordered set such that the first positive identification applies.

The system may default to a certain language group if one of two thresholding criteria is met: (a) absolute thresholding occurs when the highest probability determined by the trigram analyzer 14 is below a predetermined threshold Ti. This would mean that the trigram analyzer 14 could not determine from among the language groups a single language group with a reasonable degree of confidence; (b) relative thresholding occurs when the difference in probabilities between the language group identified as having the highest probability and the language group identified as having the second highest probability falls below a threshold Tj as determined by the trigram analyzer 14.

The default to a specified language group is a settable parameter. In an English-speaking environment, for example, a default to an English pronunciation is generally the safest course since a human, given a low confidence level, would most likely resort to a generic English pronunciation of the input name. The value of the default as a settable parameter is that the default would be changed in certain situations, for example, where the telephone exchange indicates that a telephone number is located in a relatively homogeneous ethnic neighborhood.

As mentioned earlier, the name and language tag (LTAG) sent by either the filter 12 or the trigram analyzer 14 is received by the letter-to-sound rule section 20. The letter-to-sound rule section 20 is broken up conceptually into separate blocks for each language group. In other words, language group (L_i) will have its own set of letter-to-sound rules, as does language group (L_j), language group (L_k) etc. to language group (L_n).

Assuming that the input name has been identified sufficiently so as not to generate a default pronunciation, the input name is sent to the appropriate language group letter-to-sound block 22_{i-n} according to the language tag associated with the input name.

In the letter-to-sound rule section 20, the rules for the individual language group blocks 22 are subsets of a larger and more complex set of letter-to-sound rules for other language groups including English. A letter-to-sound block 22_i for a specific language group L_i that has been identified as the language group of

origin will attempt to match the largest grapheme sequence to a rule. This is different from the filter 12 which searches top to bottom, and in this embodiment right to left, for the string of graphemes in an input name that fits a filter rule. The letter-to-sound block 22_{i-n} for a specific language scans the grapheme string from left to right or right to left, the illustrated embodiment using a right to left scan.

An example of the letter-to-sound rules for a specific block L_i can be seen for a name such as MANKIEWICZ. This input name would be identified as originating from the Slavic language group, having the highest probability, and would therefore be sent to the Slavic letter-to-sound rules block 22_i. In that block 22_i, the grapheme string -WICZ has a pronunciation rule to provide the correct segmental phonemics of the string. However, the grapheme string -KIEWICZ also has a rule in the Slavic rule set. Since this is a longer grapheme string, this rule would apply first. The segmental phonemics for any remaining graphemes which do not correspond to a language specific pronunciation rule will then be determined from the general pronunciation block. In this example, the segmental phonemics for the graphemes M, A, and N would be determined (separately) according to the general pronunciation rules. The letter-to-sound block 22_i sends the concatenated phonemics of both the language-sensitive grapheme strings and the non-language-sensitive grapheme strings together to the voice realization unit 50 for pronunciation.

The filter 12 does not contain all of the larger strings which are language specific that are in the letter-to-sound rules 20. The larger strings are not all needed since, for example, the string-WICZ would positively identify an input name as Slavic in origin. There is then no need for the string -KIEWICZ filter rule, since -WICZ is a subset of -KIEWICZ and thus would identify the input name.

The letter-to-sound module outputs the phonemics for names mainly in the form of segmental phonemic information. The output of the letter-to-sound rule blocks 22_{i-n} serve as the input to stress sections 24_{i-n}. These stress sections 24_{i-n} take the LTAG along with the phonemics produced by individual letter-to-sound rule blocks 22_{i-n} and output a complete phonemic string containing both segmental phonemes (from letter-to-sound rule blocks 22_{i-n}) and the correct stress pattern for that language. For example, if the language identified for the name VITALE was Italian, and letter-to-sound rule block 22 provided the phoneme string [vitali], then the stress section 24_i would place stress on the penultimate syllable so that the final phonemic string would be [vitali].

It should be noted that the actual rules used in the filter 12, in the letter-to-sound section 20, and the stress sections 24_{i-n} are rules which are either known or easily acquired by one skilled in the art of linguistics.

The system described above can be viewed as a front end processor for a voice realization unit 50. The voice realization unit 50 can be a commercially available unit for producing human speech from graphemic or phonemic input. The synthesizer can be phoneme-based or based on some other unit of sound, for example diphone or demi-syllable. The synthesizer can also synthesize a language other than English.

Figure 2 shows a language group identification and phonetic realization block 60 as part of a system. The language group identification and phonetic realization block 60 is made up of the functional blocks shown in Figure 1. As shown, the input to the language identification and phonetic realization block 60 is the name, the filter rules and the trigram probabilities. The output is the name, the language tag and phonemics, which are sent to the voice realization unit 50. It should be noted that phonemics means in this context, any alphabet of sound symbols including diphones and demi-syllables.

The system according to Figure 2 marks grapheme strings as belonging to a particular language group. The language identifier is used to pre-filter a new data base in order to refine the probability table to a particular data base. The analysis block 62 receives as inputs the name and language tag and statistics from the language identification and phonetic realization block 60. The analysis block takes this information and outputs the name and language tag to a master language file 64 and produces rules to a filter rule store 68. In this way, the data base of the system is expanded as new input names are processed so that future input names will be more easily processed. The filter rule store 68 provides the filter rules to the filter 12 and the language identification and phonetic realization block 60.

The master file contains all grapheme strings and their language group tag. This block 64 is produced by the analysis block 62. The trigram probabilities are arranged in a data structure 66 designed for ease of searching for a given input trigram. For example, the illustrated embodiment uses an N-deep three dimensional matrix where n is the number of language groups.

Trigram probability tables are computed from the master file using the following algorithm:

—0372734A1_I_>

```
compute total number of occurrences of each trigram for
all language groups L (1-N);
        for all grapheme strings S in L
                for all trigrams T in S
                        if (count [T][L] = 0)
                            uniq [L] + = 1
                        count [T][L] + = 1

for all possible trigrams T in master
        sum = 0
        for all language groups L
            sum + = count [T][L]/uniq[L]
        for all language groups L
            if sum >0,prob[T][L]=count [T][L]/uniq[L]/sum
            else prob[T][L]=0.0;
```

The trigram frequency table mentioned earlier can be thought of as a three-dimensional array of trigrams, language groups and frequencies. Frequencies means the percentage of occurrence of those trigram sequences for the respective language groups based on a large sample of names. The probability of a trigram being a member of a particular language group can be derived in a number of ways. In this embodiment, the probability of a trigram being a member of a particular language group is derived from the well-known Bayes theorem, according to the formula set forth below:

Bayes' Rule states that the probability that Bj occurs given A, P(Bj|A), is

$$P(Bj|A) = \frac{P(A|Bj)\,P(Bj)}{\sum_i P(A|Bi)\,P(Bi)}$$

More specific to the problem, the probability a language group given a trigram, T, is P(Li|T), where

$$P(Li|T) = \frac{P(T|Li)\,P(Li)}{\sum_k P(T|L_k)\,P(L_k)}$$

analyzing further

$P(T|Li) = \frac{X}{Y}$

where X = number of times the token, T, occurred in the language group, Li

Y = number of uniquely occurring tokens in the language group, Li

$P(L_i) = \frac{1}{N}$ always

where N = number of language groups (nonoverlapping)

$\therefore$

$$P(L_i|T) = \frac{\frac{P(T|L_i)}{N}}{\sum_{k=1}^{N} \frac{P(T|L_k)}{N}} = \frac{P(T|L_i)}{\sum_{k=1}^{N} P(T|L_k)}$$

$\because$

The final table then has four dimensions; one for each grapheme of the trigram, and one for the language group.

The trigram probabilities as computed by the block 66 are sent to the language identification and phonetic realization block 60, and particularly to the trigram analyzer 14 which produces the vector of probabilities that the grapheme string belongs to a particular language group.

Using the above-described system, names can be more accurately pronounced. Further developments such as using the first name in conjunction with the surname in order to pronounce the surname more accurately are contemplated. This would involve expanding the existing knowledge base and rule sets.

Claims

1. A method for positively identifying or eliminating a language group ($L_i...L_n$) as a language group of origin for a given word, comprising:
comparing substrings of graphemes of an input word to a stored set of filter rules until either a match of one of the substrings to one of the filter rules positively identifies a language group, or any language group is eliminated when a match of one of the substrings to one of the filter rules indicates a language group is eliminated from consideration as a language group of origin for the input word; and
producing a list of possible non-eliminated language groups of origin when no language group is positively identified as the language group of origin or indicating the language group of origin when the language group of origin is positively identified.

2. A method as claimed in claim 1, wherein said comparing step includes the step of searching the filter rules from top to bottom and right to left.

3. A method as claimed in claim 1, wherein the comparing step includes the step of searching the filter rules by language group and by grapheme within each language group.

4. A method for generating correct phonemics for a given input word according to a language group of origins of the input word, the method comprising:
filtering the input word in a filter (12) to identify a language group of origin for the input word or to eliminate at least one language group of origin for the input word;
sending the input word and a language tag indicating a language group of origin for the input word from the filter to a letter-to-sound module (22) containing letter-to-sound rules when the filter positively identifies a language group of origin for the input word;
sending from the filter the input word and any non-eliminated language groups to a grapheme analyser (14) when a language group of origin for the input word is not positively identified by the filter;
producing a most probable language group of origin for the input word by analysing graphemes in the input word;
sending the input word and the most probable language group of origin to a subset of the letter-to-sound module corresponding to the most probable language group;
producing in the subset of letter-to-sound module segmental phonemics for the input word;
sending the segmental phonemics and the language tag from the letter-to-sound module to a stress assignment section (24);
producing stress assignment information for the input word in the stress assignment section; and
sending the segmental phonemics and the stress assignment information to a voice realisation unit (50).

5. A method as claimed in claim 4, wherein the graphemes are trigrams.

6. A method as claimed in claim 4 or 5, wherein the step of producing a most probable language group of origin includes the step of computing probabilities of graphemes for an input word being from a particular language group using Bayes' Rule.

7. A method as claimed in claim 4, 5 or 6, further comprising the step of defaulting to a general pronunciation when the step of producing a most probable language group of origin produces a most probable language group of origin having a probability below a predetermined threshold level.

8. A method as claimed in claim 4, 5, 6 or 7, further comprising the step of defaulting to a general pronunciation when the step of producing a most probable language group of origin produces a most probable language group of origin having a probability that is not greater by a predetermined amount than a probability of a next most probable language group of origin.

9. A method as claimed in any of claims 4 to 8 including first searching a dictionary (10) for an entry corresponding to the input word, each entry containing a word and phonemics for that word; and
sending an entry to the voice realisation unit for pronunciation when the dictionary searching reveals that entry corresponding to the input words.

10. Apparatus for positively identifying or eliminating a language group ($L_i...L_n$) as a language group or origin for a given word, comprising:
a filter rule store (68) which stores a set of filter rules, a first subset of the filter rules positively identifying a language group, and a second subset of the filter rules eliminating a language group;
a comparator (12) which compares substrings of graphemes of an input word to the first and second subsets of filter rules until a match of one of the substrings to one of the first subset of filter rules positively identifies a language group or eliminates any language group when a match of one of the substrings to one of the second subset of filter rules indicates a language group is eliminated from consideration as a language group of origin for the input word; and
an output which produces a list of possible language groups of origin when no language group is positively identified as the language group of origin, and which produces an indication of the language group of origin when the language group of origin is positively identified.

11. Apparatus as claimed in claim 10 including an analyser (14) for calculating the most probable language group of origin for the graphemes in the given word for each language not eliminated by the second subset of the filter rules received from the output.

12. Apparatus as claimed in claim 11 in which the analyser analyses graphemes in the given word arranged into trigrams

FIG. 1

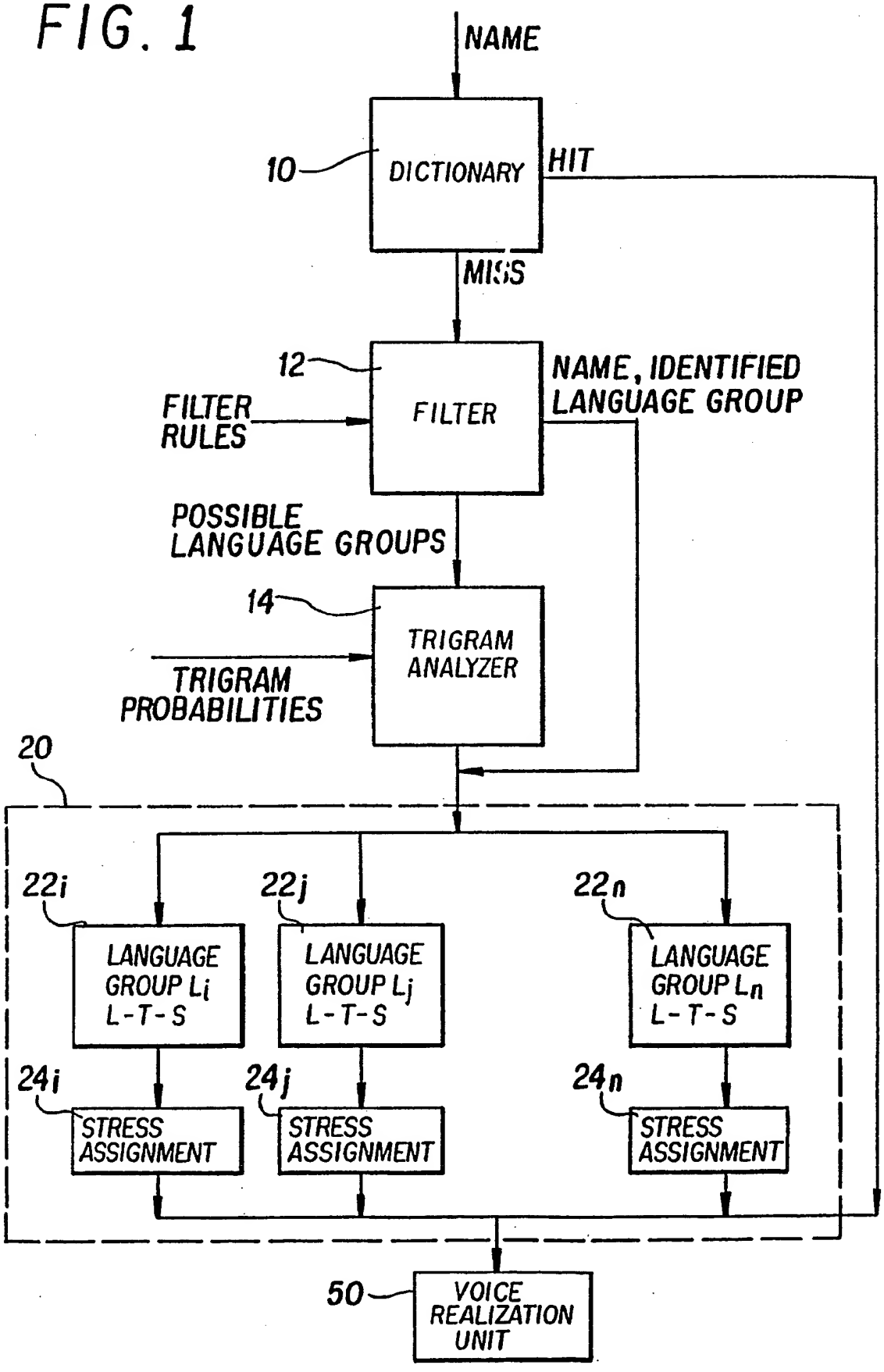
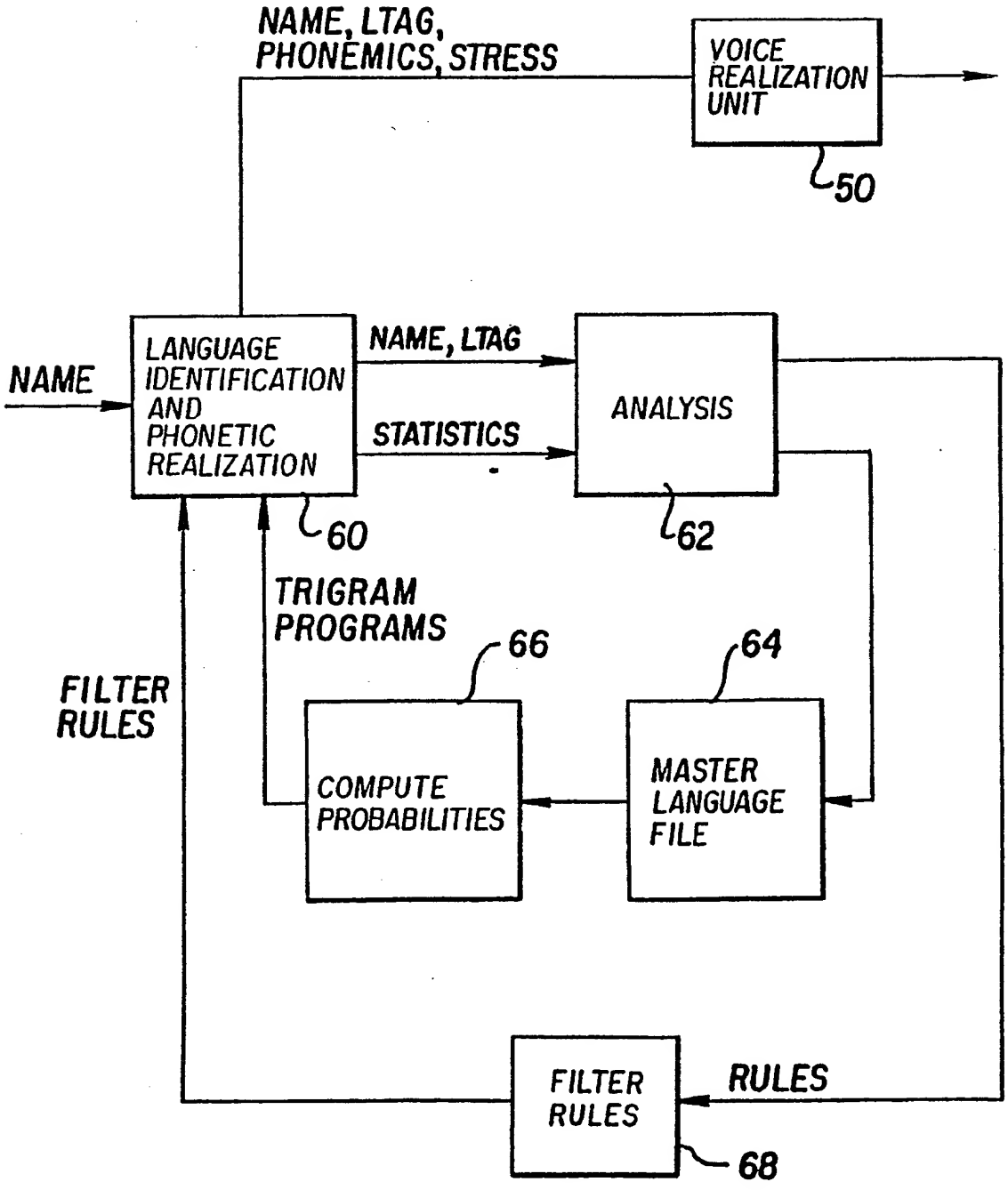

NAME
10
DICTIONARY
HIT
MISS
12
FILTER
FILTER RULES
NAME, IDENTIFIED LANGUAGE GROUP
POSSIBLE LANGUAGE GROUPS
14
TRIGRAM ANALYZER
TRIGRAM PROBABILITIES
20
22i
22j
22n
LANGUAGE GROUP Li L-T-S
LANGUAGE GROUP Lj L-T-S
LANGUAGE GROUP Ln L-T-S
24i
24j
24n
STRESS ASSIGNMENT
STRESS ASSIGNMENT
STRESS ASSIGNMENT
50
VOICE REALIZATION UNIT

FIG. 2


NAME, LTAG, PHONEMICS, STRESS
VOICE REALIZATION UNIT
50
NAME
LANGUAGE IDENTIFICATION AND PHONETIC REALIZATION
NAME, LTAG
STATISTICS
ANALYSIS
60
62
TRIGRAM PROGRAMS
66
64
FILTER RULES
COMPUTE PROBABILITIES
MASTER LANGUAGE FILE
FILTER RULES
RULES
68

ABSTRACT OF THE DISCLOSURE

An apparatus and method for correctly pronouncing proper names from text using a computer provides a dictionary which performs an initial search for the name. If the name is not in the dictionary, it is sent to a filter which either positively identifies a single language group or eliminates one or more language groups as the language group of origin for that word. When the filter cannot positively identify the language group of origin for the name, a list of possible language groups is sent to a grapheme analyzer. Using grapheme analysis, the most probable language group of origin for the name is determined and sent to a language-sensitive letter-to-sound section. In this section, the name is compared with language-sensitive rules to provide accurate phonemics and stress information for the name. The phonemics (including stress information) are sent to a voice realization unit for audio output of the name.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 31 1830

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	IBM TECHNICAL DISCLOSURE BULLETIN, vol. 27, no. 7A, December 1984, page 3681, New York, US; P.S. COHEN et al.: "Mehtod for improving spelling-to-sound rules for speech synthesis using algorithmically deduced etymologies" * Whole article *	1-12	G 10 L 5/04

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

G 10 L 5/04

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	08-03-1990	ARMSPACH J.F.A.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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